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| **Lesson Title:**  **GETTING TO KNOW “UNKNOWN VARIABLES”**  **Common Uses of Variables in Algebra** |
| **Subject area / course / grade level:**  **Algebra / Math / Grades 5 – 6** |
| **Introduction:**  This lesson is designed to focus on a major content topic in the algebra curriculum – understanding the concept of variables. Students in early elementary grades often encounter common uses of variables as they learn and practice their basic facts for addition, subtraction, multiplication, and division. One use is represented in equations in which children have to fill-in a “missing” or “unknown” value or place-holder. For example, children solve many exercises like the following:  + 5 = 13.  However, as students enter middle school, this exercise might simply change to ***n* + 5 = 13**. Students are taught to find the value of ***n*** by the “undoing” process involving one-step equation solving. This Sample Lesson is designed to bridge the connection between children’s early experiences with algebraic thinking and their more formal encounters with algebra in upper grades. Students will also learn how to use variables in expressions and simple equations. A portion of the lesson will focus on the order of operations. |
| **Lesson Length:**  **60 minutes** |
| **Materials:**  24 Game® – Algebra version  Handouts for Students and/or Teacher (Uses of Variables chart; Instructions for games)  Math Notebooks  Paper and Pencil |
| **Lesson Overview:**  Students will begin the lesson by demonstrating “**THink Of A Number” (THOAN)** task(s). They will then play several rounds of a game entitled **“Guess My Rule.”** These activities will enhance students’ former experiences with algebraic thinking as they discover general expressions to represent number patterns. Then students will be introduced to common uses of variables; examples will be provided. Lastly, students will have a chance to solve **24 Game®** exercises (Algebra version), focusing on order of operations. |
| **Tennessee Standards:**  GLE 0506.3.1 Understand and use order of operations.  GLE 0506.3.2 Develop and apply the concept of variable.  GLE 0506.3.4 Solve single-step linear equations and inequalities.    GLE 0606.3.2 Interpret and represent algebraic relationships with variables in expressions, simple equations and inequalities.  GLE 0606.3.4 Use expressions, equations and formulas to solve problems.  GLE 0606.3.5 Use multiple representations including symbolic algebra to model and/or solve contextual problems that involve  linear relationships.    **MCS/Math Power Standards:**    Grade 5 - Develop and apply the concept of an unknown variable to solve single-step equations.  Grade 6 - Use expressions, equations and formulas to solve problems.  - Use order of operations in solving problems.  -Use algebraic expressions and properties to analyze numeric and geometric patterns.  - Interpret and represent algebraic relationships with variables in expressions, simple equations and  inequalities. |
| **Lesson objective/outcome(s):**  **TLW:** Demonstrate an understanding of vocabulary used in algebraic thinking.  Discover general expressions using variables to represent number patterns.  Write and solve single-step equations using variables. |
| **ENGAGE**   * How will the teacher capture students’ interest? * What kind of questions should the students ask themselves after the engagement?   **Activity: THink Of A Number** **(THOAN)**  Below are two THOAN exercises that you can use to launch this lesson. Simply verbalize to students the *written* directions in the order given; encourage them to write their results in a “step-by-step” or vertical format, as it will be easier to see their starting and ending numbers. (For a key guide, a numerical example is given **in** **bold**. Also at each step, the algebraic expression is shown *in italics*, which helps to “prove” why the ending result is as it is.)  THOAN 1 - Written Directions **Numerical Ex.** *Algebraic Expression*   * Think of a Number between 1 and 100. **9** *n* * Add 4. **13** *n + 4* * Multiply by 3. **39** *3(n+4) = 3n+12* * Subtract 12. **27** *3n +12–12 = 3n* * Divide by your starting number. **3**  *3nn = 3*   THOAN 2 - Written Directions **Numerical Ex.** *Algebraic Expression*   * Think of a Number. **50** *n* * Multiply by 2. **100** *2n* * Add 10. **110** *2n+10* * Divide by 2. **55** *(2n+10) 2 = n+5* * Subtract 4. **51** *n +5–4 = n+1*   **NOTE:** For THOAN 1, students should end with the same number, 3. For THOAN 2, they should end with one more than their starting number. Other THOANs can be created to give different results. Based on the intended result of the THOAN exercise, sample questions can be posed to students with discussion following.  **Questions (Sample Questions - based on the THOAN exercise):**  1. (THOAN 1) What is your ending number? Did everyone get the same value? If so, why? Explain.  2. Compare your ending number to your classmates. Is it the same? If so, why? Explain.  3. (THOAN 2) How does your ending number compare to your starting number? Can you explain why?  4. Work with a partner to create a THOAN exercise with an ending number of 1 (*or* 2, 3, 4, 5, …).  5. Work with a partner to create a THOAN exercise with an ending value that is two more than your starting number  (or one less than your starting number). |
| **EXPLORATION**   * What hands-on/minds-on activities will students be doing? * What are the “big idea” conceptual questions that the teacher will use to encourage and/or focus students’ exploration?   **Hands-on/Minds-on Activities:**  1. THOAN Task (Refer to ENGAGE Activity above.)  2. “Guess My Rule” Game (See handout for instructions.)  3. Uses of Variables Chart (See handout.)  4. **24 Game®** - Algebra version (See handout for instructions.)  5. Teacher/students record observations and some examples for future discussion.  **Big-Idea Questions include:**   1. What is the purpose of variables? 2. Why is it important to find the value of a variable in an equation? 3. Why is it important to know and follow the rules for order of operations? 4. Where might you need to incorporate the use of variables in real-life?   (Examples might be: People who are in careers such as banking, accounting, teaching, computer science, medicine, engineering, electronics, scientists, etc.)  **At-Home Exploration:**  Given teacher/parent preview and supervision, students may explore the following websites for more practice. Parents may enhance their own algebraic understanding by working with the students at home. They can work through the on-line activities with their child, thereby reinforcing everyone’s understanding of variables and algebraic thinking as well.  [www.virtualmanipulatives.com](http://www.virtualmanipulatives.com)  [www.mathplayground.com/games](http://www.mathplayground.com/games)  [www.homeschoolmath.net/online/algebra](http://www.homeschoolmath.net/online/algebra)  [www.onlinemathlearning.com](http://www.onlinemathlearning.com)  [www.mrlsmath.com](http://www.mrlsmath.com)  [www.thefutureschannel.com/algebra](http://www.thefutureschannel.com/algebra) (This website features math movies illustrating how algebra skills are incorporated in different careers.) |
| **EXPLANATION**   * Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination? * List higher order thinking questions which teachers will use to solicit *student* explanations and help them to justify their explanations.   **Games:**  Learning algebraic concepts through games can be purposeful and fun. Using games in a meaningful way is good for helping students achieve maximum learning and retention. The two games in this lesson are **“Guess My Rule”** and **24 Game®** (Algebra version). (See handouts for instructions.)  **Chart:**  The **Uses of Variables** chart should be discussed with the class at the teacher’s discretion. The chart merely illustrates, with examples, common ways variables are used in math. The chart could be posted in the classroom for student reference. Students may create and record additional examples of uses in their Math Notebooks.  **Big-Idea Questions include:**  1. What is the purpose of variables?  2. Why is it important to find the value of a variable in an equation?  3. Why is it important to know and follow the rules for order of operations?  4. List new vocabulary words that should be included in your Math Notebooks or added to the Math Wall. |
| **ELABORATION**   * Describe how students will develop a more sophisticated understanding of the concept. * What vocabulary will be introduced and how will it connect to students’ observations? * How is this knowledge applied in our daily lives? * Students will create their own rules for “Guess My Rule” game to play at school and at home. * Students will choose starting values for the variables ***x*** and/or ***y*** in the **24 Game®** (Algebra version).     **Vocabulary:**  equation, expression, input, order of operations, output, pattern, reasoning, single-step, symbols, unknown, variables |
| **EVALUATION**   * How will students demonstrate that they have achieved the lesson objective? * This should be embedded throughout the lesson as well as at the end of the lesson * Teacher/student observations and on-going discussion * Students’ created rules for the “Guess My Rule” game * Students’ equations written to solve **24 Game®** exercises * Recorded notes and examples in students’ Math Notebooks |

**NOTES:**